スーパーＴＦＴ受賞記念

1997年3月13日

受賞リスト

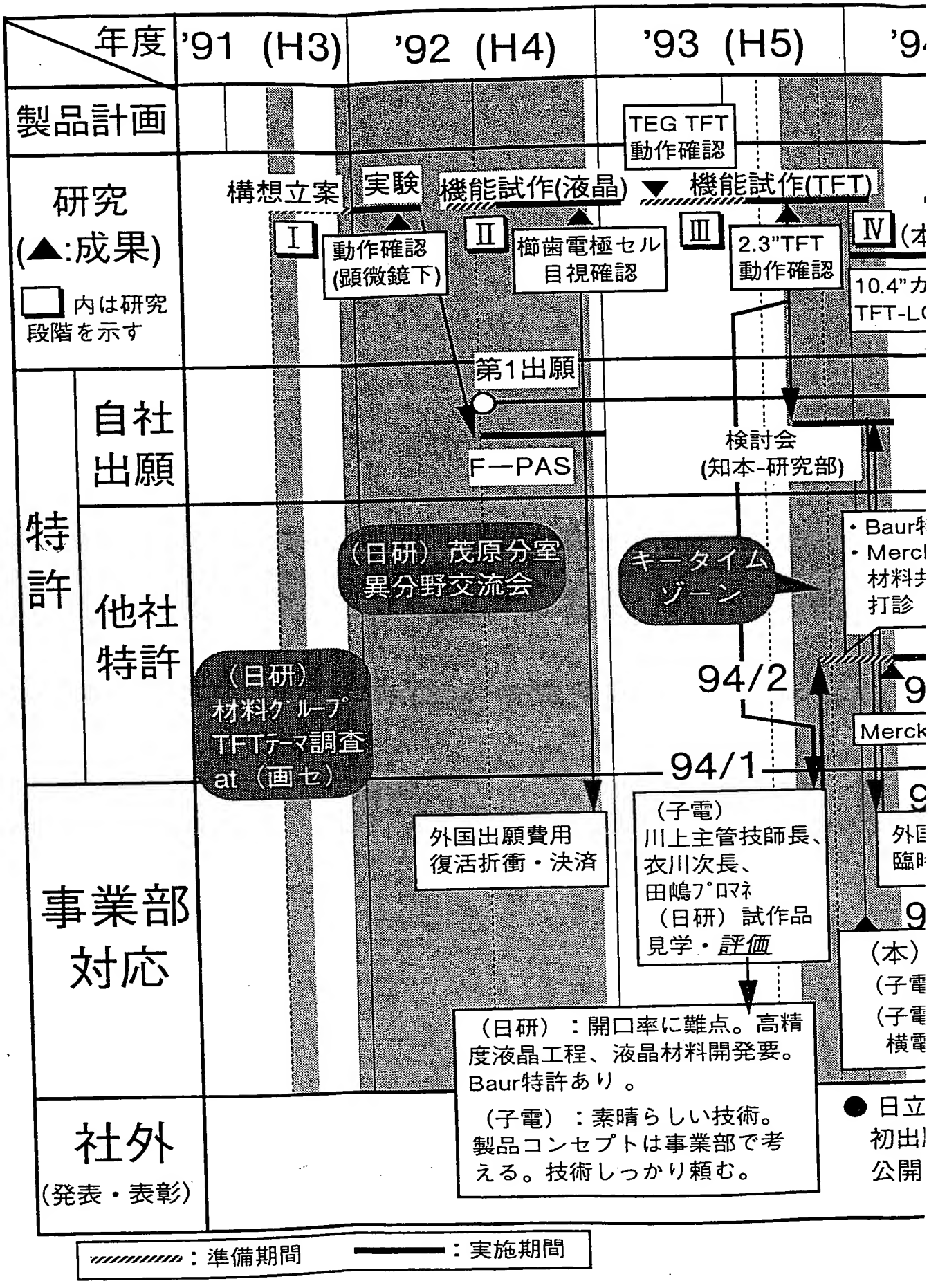
1）1996年日経ＢＰ技術賞　大賞　('96.4)
"ＣＲＴなみの画質を実現可能な「スーパーＴＦＴ技術」"
（株）日立製作所
日立研究所画像デバイス研究部　主任研究員　近藤　克己
電子デバイス事業部画像開発センタ　技師　太田　益幸
電子デバイス事業部画像開発センタ　技師　大江　昌人

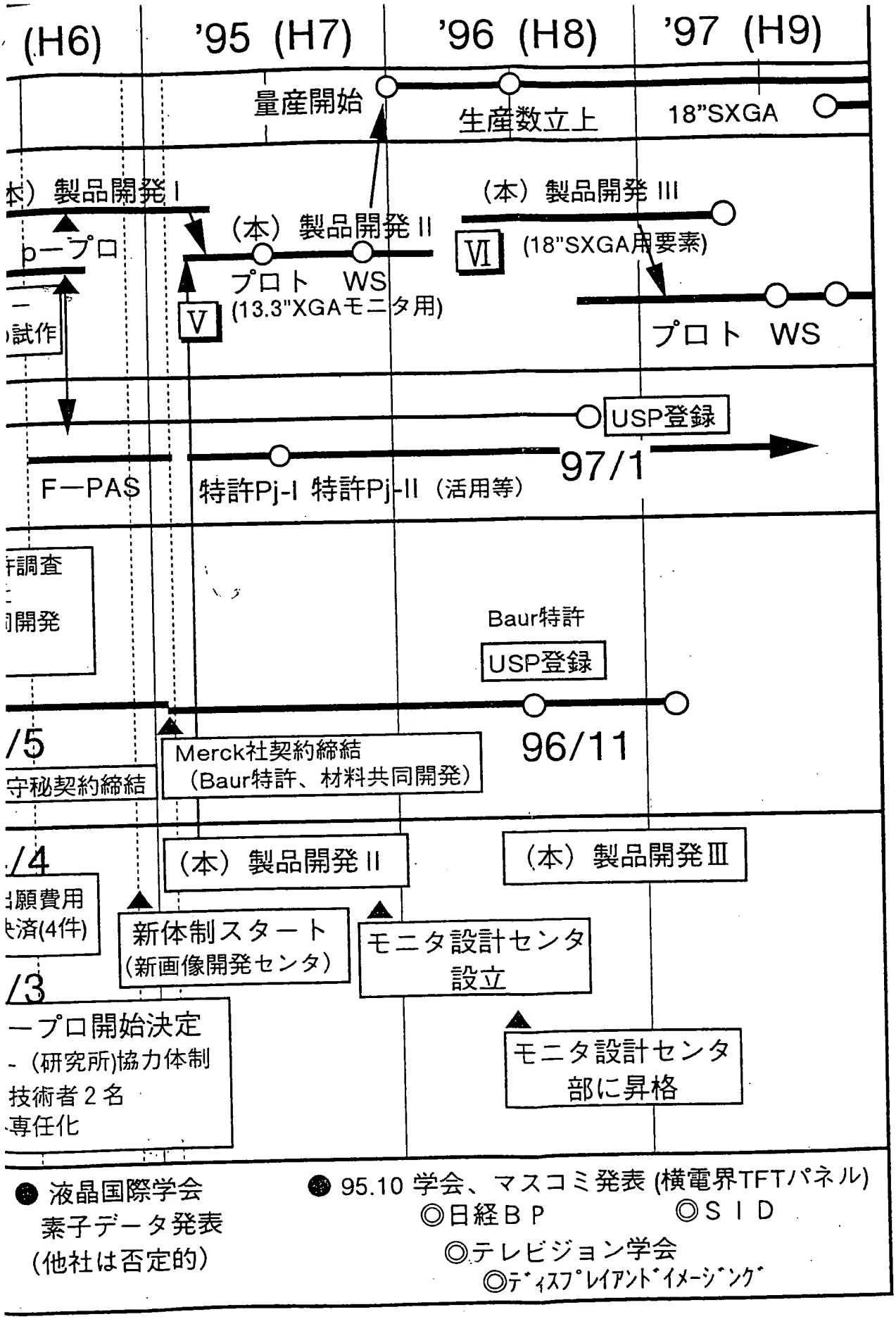
2）（社）テレビジョン学会　藤尾記念賞　('96.5)
"超広視野角スーパーＴＦＴ液晶ディスプレイの開発"
（株）日立製作所スーパーＴＦＴ開発グループ
代表　近藤　克己

3）アドバンスト ディスプレイ オブ ザ イヤー'96、
ディスプレイ モジュール部門 グランプリ　('96.7)
（主催：ディスプレイアンドイメージング、
共催：リード・エグジビジョン・ジャパン（株））
"超広視野角を実現した大画面高精細のスーパーＴＦＴ技術"
（株）日立製作所
（近藤　克己、真野　宏之、太田　益幸、大江　昌人）

4）The Society for Information Display、
1996 Display of the year award, Best of the year　('97.5)
" Hitachi's 13.3-in. Super TFT-LCD with In-Plane Switching"
Hitachi, Ltd.

スーパーTFT 研究～製品化の経過




(H6)
'95 (H7)
'96 (H8)
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量産開始
生産数立上
18"SXGA
(本) 製品開発 I
(本) 製品開発 II
(本) 製品開発 III
pープロ
プロト WS
(13.3"XGAモニタ用)
V
VI
(18"SXGA用要素)
プロト WS
試作
USP登録
97/1
F—PAS
特許Pj-I 特許Pj-II (活用等)
Baur特許
USP登録
96/11
Merck社契約締結
(Baur特許、材料共同開発)
守秘契約締結
(本) 製品開発 II
(本) 製品開発 III
新体制スタート
(新画像開発センタ)
モニタ設計センタ
設立
モニタ設計センタ
部に昇格
ープロ開始決定
(研究所)協力体制
技術者2名
専任化
液晶国際学会
素子データ発表
(他社は否定的)
95.10 学会、マスコミ発表 (横電界TFTパネル)
◎日経BP
◎SID
◎テレビジョン学会
◎ﾃﾞｨｽﾌﾟﾚｲｱﾝﾄﾞｲﾒｰｼﾞﾝｸﾞ

1996年

日経BP技術賞

大賞

CRTなみの画質を実現可能な
「スーパーTFT技術」

株式会社日立製作所

日立研究所画像デバイス研究部　主任研究員　近藤 克己 殿

応用デバイス事業部画像開発センタ　技師　太田 益幸 殿

応用デバイス事業部画像開発センタ　技師　大江 昌人 殿

上記の技術は，1996年日経BP技術賞で
頭書の賞に選ばれました。
ここにこれを表します。

1996年4月5日

日経BP社

代表取締役
社長　鈴木 隆

Nikkei Business Publications, Inc.

ITE

藤尾記念賞

株式会社日立製作所
スーパーTFT開発グループ 殿

あなたがたは一致協力して液晶ディスプレイの欠点である視野角特性の抜本的改善の研究に取組み横電界液晶とTFT技術を組合わせた新しい液晶ディスプレイ構成を開発し実用性を確証されました
本研究による超広視野角スーパーTFT液晶ディスプレイの視野角は百四十度を超え今後の画像表示システムの発展に大きく寄与するものと期待されます
よってここに藤尾記念賞を贈呈いたします

平成八年 十五日

社団法人 テレビジョン学会

会長 高木幹雄

表彰状

第1回アドバンスト・ディスプレイ・オブ・ザ・イヤー'96
ディスプレイモジュール部門
グランプリ

CRT並みの画質を実現可能な「スーパーTFT技術」

株式会社 日立製作所 殿

貴殿は過去1年間を通してディスプレイ産業の
発展に大きく貢献する最も優秀なる技術・
製品を開発されました
よってここに栄誉を称えこれを表彰いたします

1996年7月3日

主催「ディスプレイ アンド イメージング」
共催 リード エグジビション ジャパン株式会社
サイエンス・コミュニケーションズ・インターナショナル(株)
会長 Martin B. Gordon

YTH TRANSLATION
Awards for Hitachi Super-TFT

Super-TFT Award Commemoration

March 13, 1997

Award List

1) 1996 Nikkei BP Technical Award. Grand prize (April 1996)

"Super-TFT Technology: Capable of realizing the CRT comparative image quality"

Hitachi Co., Ltd.

Katsumi Kondo, Chief Researcher. Hitachi Research Center, Image Device Research Division
Masuyuki Ohta, Technical Staff, Electron Tube & Device Division Image Development Center
Masato Oh-e, Technical Staff, Electron Tube & Device Division Image Development Center

2) Television Society, Inc., Fujio Commemorative Award (May, 1996)

"Development of Super-TFT LCD with an ultra-wide viewing angle"

Super-TFT Development Group. Hitachi Co., Ltd.

Representative: Katsumi Kondo

3) Advanced Display of the Year '96
Display Module Section, Grand Prix (July 1996)
(Sponsored by: Display and Imaging and
Co-sponsored by: Lead Exhibition Japan, Ltd.)

"Large screen size and high precision super-TFT technology with an ultra-wide viewing angle"

Hitachi Co., Ltd.
(Katsumi Kondo, Hiroyuki Mano, Masuyuki Ohta, and Masato Oh-e)

YTH TRANSLATION
Awards for Hitachi Super-TFT

1996
Nikkei BP Technical Award
Grand prize

"Super-TFT Technology"
Capable of realizing the CRT comparative image quality"

Hitachi Co., Ltd.

Mr. Katsumi Kondo, Chief Researcher, Hitachi Research Center, Image Device Research Division
Mr. Masuyuki Ohta, Technical Staff, Electron Tube & Device Division Image Development Center
Mr. Masato Oh-e, Technical Staff, Electron Tube & Device Division Image Development Center

The Technology above was selected for the said award of the

1996 Nikkei BP Technical Award.

Here the award is presented.

April 5, 1996

Nikkei Business Publications, Inc.

Representative, President
Takashi Suzuki (seal)

YTH TRANSLATION
Awards for Hitachi Super-TFT

Fujio Commemorative Award

To: Super-TFT Development Group, Hitachi Co., Ltd.

You have cooperated for the research in order to fundamentally improve the viewing angle characteristic which has been the disadvantage of the liquid crystal displays, developed a new liquid crystal display constitution combining the transverse electric field liquid crystal and the TFT technology, and proved the practicability thereof.

The viewing angle in the super-TFT liquid crystal display with the ultra-wide viewing angle of the present research exceeds 140 degrees, and we anticipate that it will make a great contribution to the future development of the image display system.

Here the Fujio Commemorative Award is presented.

May 15, 1996

Television Society, Inc.

President
Mikio Takagi (seal)

YTH TRANSLATION
Awards for Hitachi Super-TFT

Official Commendation

The First Advanced Display of the Year '96

Display Module Section

Grand Prix

"Super-TFT Technology"
Capable of realizing the CRT comparative image quality"

Hitachi Co., Ltd.

You have developed the most superior technology and product of the past year which will make a great contribution to the development of the display industry.

By honoring your accomplishment, the award is presented here,

July 3, 1996

Sponsored by: Display and Imaging

Co-sponsored by: Lead Exhibition Japan, Ltd.

Science Communication International Co., Ltd.

Martin B. Gordon, President (seal)

SID

SOCIETY FOR INFORMATION DISPLAY

Society for Information Display

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&
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Hynes Convention Center
Boston, Massachusetts
May 11-16, 1997

SID NEWS

International Society for Information Display Awards

At this year's Symposium, the Society is pleased to honor the following individuals for their important contributions to the display profession and to the Society:

Karl Ferdinand Braun Prize

Mr. Isamu Washizuka
"For outstanding contributions to the development of LCDs, in particular to the field of large-area LCDs."

Fellow Awards

The following awardees have been made Fellows of the Society:

Dr. Louis D. Silverstein
"For scientific contributions to the design and evaluation of LCDs, including novel methods for display modeling and simulation."

Mr. Eiichi Yamaguchi
"For outstanding contributions to the CRT industry, including the development of segmented lens exposure systems, high-resolution data display tubes, and CRT projectors."

Mr. James Fergason
"For pioneering contributions to the field of liquid crystals and inventive applications to displays."

Dr. Günter Baur
"For pioneering contributions to the understanding and development of LCDs, including the invention of the in-plane-switching effect."

Special Recognition Awards

The following awardees will receive special recognition:

Professor Atsuo Fukada
"For the discovery of anti-ferroelectric liquid crystals and contributions to the understanding of liquid-crystal structures and properties."

Mr. Hisao Hakamishi
"For the development of improved oxide cathodes, innovative CRT technologies, and advances in CRT reliability."

Dr. Bernhard Schaible
"For pioneering contributions to the development of liquid-crystal materials for LCD applications, and for vision and leadership in the growth of this industry."

Mr. Georg Weber
"For pioneering contributions to the development of liquid-crystal materials for LCD applications, and for vision and leadership in the growth of this industry."

Mr. Shoji Shiral
"For contributions to the development of low-aberration electron guns and electron-beam simulation techniques."

Mr. Shuji Iwata
"For important contributions to the development of a large-screen color flat-matrix CRT."

Mr. Richard E. Holmes
"For entrepreneurship and vision in creating an important market for high-performance projection displays."

Best Paper Awards for SID '96

At this year's Symposium, the Society is pleased to award the following individuals for their contributions to SID '96:

Best Contributed Paper Award

M. A. Handschy, D. Banas, H. Chase, J. Cunningham, R. Matzbender, M. R. Meadows, Displaytech, Inc., Boulder, CO; D. Ward, Black Forest Engineering, Inc., Colorado Springs, CO
"Miniature FLC/CMOS Color Sequential Display Systems"

Best Contributed Paper Award (Honorable Mention)

M. Honda, I. Yonetani, T. Ose, N. Arimoto, Matsushita Electron Tube Development Center, Osaka, Japan; K. Shimada, Matsushita Electronics Research Laboratory, Osaka, Japan
"Development of Yoke for 'Pure Flat' 17-in. CRT"

Best Student Paper Award

X. Zhang, B. A. Wandell, Stanford University, Stanford, California
"A Spatial Extension of CIELAB for Digital Color Image Reproduction"

Best Student Paper Award (Honorable Mention)

M. H. Schuck, D. J. McKnight, K. M. Johnson, University of Colorado at Boulder, Boulder, Colorado
"Automotive Head-Up Display Using Liquid-Crystal-on-Silicon Displays"

Best Applications Paper Award

D. Coates, M. J. Goulding, S. Greenfield, J. M. W. Hanmer, S. A. Marden, O. L. Parri, Merck Ltd., Dorset, U. K.
"High-Performance Wide-Bandwidth Reflective Cholesteric Polarizers"

Best Poster Paper Award

A. Horibe, E. Nihei, Y. Koike, Keio University, Yokohama, Japan
"Bright LCD Backlight Using High-Scattering Optical-Transmission Polymer"

Best Poster Paper Award (Honorable Mention)

N. Koma, R. Nishikawa, Sanyo Electric Co., Ltd., Gifu, Japan; K. Tarumi, Merck KGaA, Darmstadt, Germany
"Development of a Simple Process to Fabricate High-Quality TFT-LCDs"

Awards Dinner

The international awards will be presented at the SID Annual Business Meeting on Tuesday, May 13, and the SID '96 Best Paper Awards will be presented at the Annual SID Luncheon on Wednesday, May 14. There will be a dinner honoring all award recipients on Monday evening, May 12, in the Independence Ballroom of the Sheraton Boston Hotel. *Tickets for the dinner are available only through pre-registration, and will not be available on-site.* (See Advance Registration Form in the centerfold.)

Publications

The Society welcomes contributions to its two major publications, the monthly magazine, *Information Display*, and the quarterly *Journal of the SID*. If you would like to submit articles to either or both publications, please contact *Information Display* editor Ken Werner at 203/853-7069, or *Journal* editor Alan Sobel at 847/869-5807.

Electronic and CD-ROM Versions of SID '97 Digest

SID once again has plans to publish the SID '97 Symposium Digest electronically on the World Wide Web. The Digest will be directly viewable through commercially available Internet browsers. The papers contained in the Digest will be available for hypertext referencing from subsequent electronically published material on the Web. The Digest will be accessible through a link on the SID home page http://www.sid.org.

CD-ROM versions of the SID '96 and SID '97 Digests are planed to be available at SID '97. Please check with the SID registration desk.

Along with technical publications, the SID home page will have information on Society activities, including local chapters and all SID-sponsored conferences. A list of the sustaining members and, when possible, links to their possible home pages will also be available. In addition, a collection of links to other Web display-related information will be assembled.

DEUTSCHE DEMOKRATISCHE REPUBLIK

PATENTSCHRIFT

(12) Wirtschaftspatent

(19) DD (11) 227 809 A1

Erteilt gemäß § 17 Absatz 1 Patentgesetz

4(51) G 02 F 1/13

AMT FÜR ERFINDUNGS- UND PATENTWESEN

In der vom Anmelder eingereichten Fassung veröffentlicht

(21)	WP G 02 F / 268 671 0	(22)	24.10.84	(44)	25.09.85
(31)	65240	(32)	26.04.84	(33)	BG

(71) Akademie der Wissenschaften der DDR, 1086 Berlin, Otto-Nuschke-Straße 22/23, DD
(72) Hauck, Gerd, Dr. Dipl.-Phys., DD; Komitov, Latschesar, Dipl.-Phys., BG; Koswig, Hans-Dieter, Prof. Dr. Dipl.-Phys., DD

(54) Verfahren zur Erzeugung eines Flüssigkristall-Bauelementes mit verdrillter Struktur

(57) Die Erfindung betrifft ein Verfahren zur Erzeugung von Flüssigkristall-Bauelementen für den Einsatz auf dem Gebiet der Elektronik und in Systemen zur Informationsdarstellung. Es ist die Aufgabe der Erfindung, ein Verfahren zur Erzeugung von Flüssigkristall-Bauelementen mit verdrillter Struktur anzugeben, die sich durch gute Reproduzierbarkeit und Homogenität über die gesamte Fläche auszeichnen. Erfindungsgemäß wird die Aufgabe dadurch gelöst, daß an eine Flüssigkristallschicht, die zwischen zwei Glasplatten angeordnet ist und eine positive dielektrische Anisotropie und eine anfängliche Deformation vom Verbiegungstyp aufweist, ein ungefähr parallel zu den Platten ausgerichtetes elektrisches Feld angelegt wird, dessen Stärke unter einem für den Freedericksz-Übergang notwendigen Wert liegt.

ISSN 0433-6461

6 Seiten

[redacted]

Verfahren zur Erzeugung eines Flüssigkristall-Bauelementes mit verdrillter Struktur

Anwendungsgebiet der Erfindung

Die Erfindung betrifft die Erzeugung von Flüssigkristall-Bauelementen mit verdrillter Struktur, wie sie in der Elektronik und in Systemen zur Informationsdarstellung benötigt werden.

Charakteristik der bekannten technischen Lösungen

Es ist, wie von G. Porte in J. Physique 37 (1976) 1245, 38 (1977) 509 und 39 (1978) 213 beschrieben, bekannt, Flüssigkristall-Bauelemente mit verdrillter Struktur zu erzeugen. Hiernach befindet sich zwischen zwei Glasplatten eine Flüssigkristallschicht, die unter dem Einfluß der Plattenoberflächen so deformiert wird, daß die Ebene ihrer Deformation ungefähr senkrecht zu den Glasplatten liegt und die Neigung der Flüssigkristallmoleküle nahe der einen Platte umgekehrt zu jener an der anderen ist. Um eine Verdrillung in eine 180°-Struktur der Flüssigkristallschicht herbeizuführen, muß die Neigung jener Moleküle, die sich in der Nähe der Glasplatten befinden, eine bestimmte, gegenüber der Normalen zur Platte gemessene kritische Größe überschreiten. Dies wird durch den gleichzeitigen Einfluß einer vorher auf die Platteninnenseiten aufgetragenen Schicht einer oberflächenaktiven Substanz und der beim Einfüllen entstehenden Flüssigkristallströmung auf die Orientierung der Flüssigkristallmoleküle erreicht.

Nachteilig ist, daß keine Reproduzierbarkeit gewährleistet werden kann und die so erzeugten Flüssigkristall-Bauelemente

[redacted]

mit verdrillter Struktur über die gesamte Fläche stark ausgeprägte Inhomogenitäten aufweisen.

Ziel der Erfindung

Ziel der Erfindung sind Flüssigkristall-Bauelemente mit verdrillter Struktur mit besseren Gebrauchseigenschaften.

Darlegung des Wesens der Erfindung

Die Aufgabe der Erfindung besteht darin, ein Verfahren zur Erzeugung von Flüssigkristall-Bauelementen mit verdrillter Struktur anzugeben, die sich durch gute Reproduzierbarkeit und Homogenität über die gesamte Fläche auszeichnen.

Diese Aufgabe wird dadurch gelöst, daß in bekannter Weise zwischen zwei Glasplatten eine Flüssigkristallschicht angeordnet ist, die unter dem Einfluß der Plattenoberflächen so deformiert wird, daß die Ebene ihrer Deformation ungefähr senkrecht zu den Glasplatten liegt und die Neigung der Flüssigkristallmoleküle nahe der einen Platte umgekehrt zu jener an der anderen ist.

Erfindungsgemäß wird an die Flüssigkristallschicht mit positiver dielektrischer Anisotropie ($\Delta\varepsilon > 0$) und einer anfänglichen Deformation vom Verbiegungstyp ein in Richtung zu den Glasplatten ungefähr parallel wirkendes elektrisches Feld angelegt, dessen Stärke E unter dem für einen Freedericksz-Übergang notwendigen Wert E_{th} liegt. Auf diese Weise ist es möglich, gut reproduzierbare und über die gesamte Fläche homogene Flüssigkristall-Bauelemente mit verdrillter Struktur zu erhalten.

Ausführungsbeispiel

Nachstehend soll die Erfindung an einem Ausführungsbeispiel erläutert werden. Wie Fig. 1 und 2a zeigen, ist zwischen den beiden Glasplatten 1 und 2 eine Flüssigkristallschicht 3 mit positiver dielektrischer Anisotropie ($\Delta\varepsilon > 0$) angeordnet. Unter dem Einfluß der Plattenoberflächen ist diese Schicht deformiert, wobei ihre Deformationsebene etwa senkrecht zu

den Glasplatten 1 und 2 liegt. Die Neigung der Flüssigkristallmoleküle nahe der einen Platte ist umgekehrt zu jener an der anderen und ihre Orientierung in der Schichtmitte ist ungefähr senkrecht zu den Glasplatten (Deformation vom Verbiegungstyp). Mittels der Elektroden 4, die in geeigneter Weise auf den Innenseiten der Platten angeordnet sind, wird gemäß Fig. 2b an die Flüssigkristallschicht ein parallel zu den Glasplatten gerichtetes elektrisches Feld angelegt. Ist dessen Feldstärke E geringer als jene (E_{th}), die für den Freedericksz-Übergang notwendig ist, verändert sich die anfängliche Deformation der Schicht und geht von der Verbiegung in eine Verdrillung um 180° über.

Erfindungsanspruch

Verfahren zur Erzeugung eines Flüssigkristall-Bauelementes mit verdrillter Struktur, bei dem sich zwischen zwei Glasplatten eine Flüssigkristallschicht befindet, die unter dem Einfluß der Plattenoberflächen so deformiert ist, daß die Deformationsebene etwa senkrecht zu den Glasplatten steht und die Neigung der Flüssigkristallmoleküle nahe der einen Platte umgekehrt zu jener an der anderen ist, gekennzeichnet dadurch, daß an die Flüssigkristallschicht mit positiver dielektrischer Anisotropie und einer anfänglichen Deformation vom Verbiegungstyp ein ungefähr parallel zu den Platten ausgerichtetes elektrisches Feld angelegt wird, dessen Stärke unter einem für den Freedericksz-Übergang notwendigen Wert liegt.

Hierzu 1 Blatt Zeichnungen

[redacted]

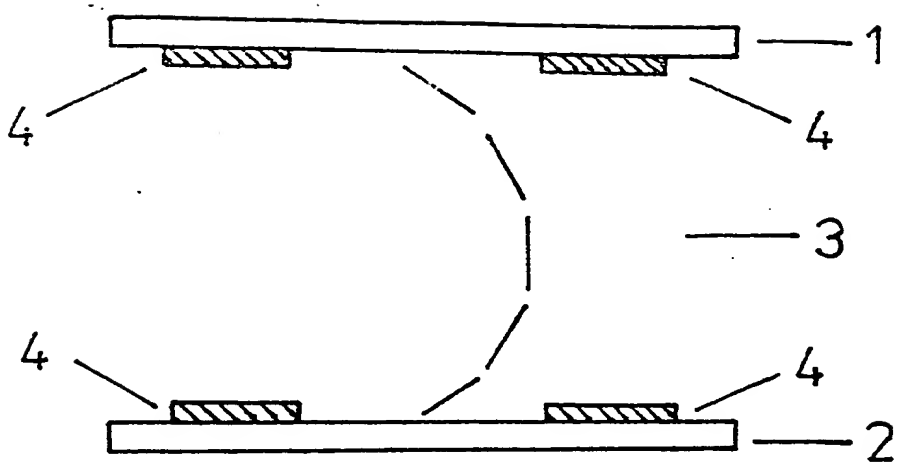

Fig. 1

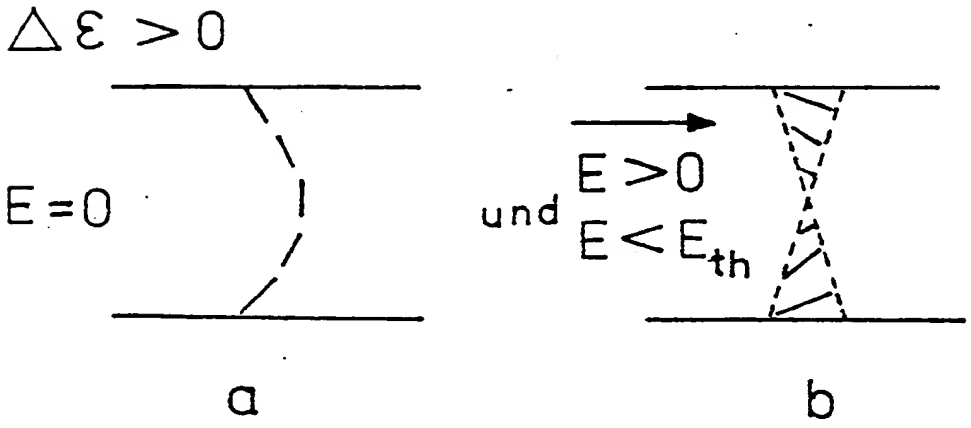

Fig. 2

GERMAN DEMOCRATIC REPUBLIC PATENT DD 227 809 A1

Process for producing a liquid-crystal component having a twisted structure

The invention relates to a process for producing liquid-crystal components for use in the area of electronics and in systems for information display. The object of the invention is to indicate a process for producing liquid-crystal components having a twisted structure which are distinguished by good reproducibility and homogeneity over the entire area. The object is achieved in accordance with the invention by subjecting a liquid-crystal layer which is arranged between two glass plates and has a positive dielectric anisotropy and an initial deformation of the bend type, to an electric field which is aligned approximately parallel to the plates and whose strength is below a value which is necessary for the Freedericksz transition.

Process for producing a liquid-crystal component having a twisted structure

Field of the invention

The invention relates to the production of liquid-crystal components having a twisted structure, as required in electronics and in systems for information display.

Characteristics of the technical solutions

It is known, as described by G. Porte in J. Physique 37 (1976) 1245, 38 (1977) 509 and 39 (1978) 213, to produce liquid-crystal components having a twisted structure. According to this, a liquid-crystal layer is located between two glass plates and is deformed under the influence of the plate surfaces in such a way that the plane of its deformation is approximately perpendicular to the glass plates and the tilt of the liquid-crystal molecules close to one plate is opposite to that at the other. In order to effect a twist into a 180° structure of the liquid-crystal layer, the tilt of each molecule located close to the glass plates must exceed a certain critical value measured against the perpendicular to the plate. This is achieved by the simultaneous effect of a layer of a surfactant applied in advance to the insides of the plates and the liquid-crystal flow, produced on filling, toward alignment of the liquid-crystal molecules.

It is disadvantageous that reproducibility cannot be ensured, and the resultant liquid-crystal components having a twisted structure have markedly different degrees of inhomogeneity over the entire area.

Aim of the invention

The aim of the invention are liquid-crystal components having a twisted structure and improved service properties.

Description of the essence of the invention

The object of the invention is to indicate a process for producing liquid-crystal components having a twisted structure which are distinguished by good reproducibility and homogeneity over the entire area.

This object is achieved by arranging, in a known manner, a liquid-crystal layer between two glass plates, which layer is deformed under the effect of the plate surfaces in such a way that the plane of its deformation is approximately perpendicular to the glass plates, and the tilt of the liquid-crystal molecules close to one plate is opposite to that at the other.

In accordance with the invention, an electric field acting in the direction approximately parallel to the glass plates with a strength E below the value E_{th} necessary for a Freedericksz transition is applied to the liquid-crystal layer having positive dielectric anisotropy ($\Delta\varepsilon>0$) and an initial deformation of the bend type. In this way, it is possible to achieve highly reproducible liquid-crystal components having a twisted structure which are homogeneous over the entire area.

Illustrative embodiment

The invention is explained below with reference to an illustrative embodiment. As shown by Fig. 1 and 2a, a liquid-crystal layer 3 having positive dielectric anisotropy ($\Delta\varepsilon>0$) is arranged between two glass plates 1 and 2. Under the influence of the plate surfaces, this layer is deformed, its deformation plane being approximately perpendicular to the glass plates 1 and 2. The tilt of the liquid-crystal molecules close to one plate is opposite to that at the other, and their alignment in the centre of the layer is approximately perpendicular to the glass plates (deformation of the bend type). By means of the electrodes 4, which are arranged in a suitable manner on the insides of the

plates, an electric field aligned parallel to the glass plates is applied to the liquid-crystal layer as shown in Fig. 2b. If its field strength E is lower than that (E_{th}) necessary for the Freedericksz transition, the initial deformation of the layer changes and is converted from bend into a twist of 180°.

Claim

Process for producing a liquid-crystal component having a twisted structure, in which a liquid-crystal layer is located between two glass plates and is deformed under the influence of the plate surfaces in such a way that the plane of deformation is approximately perpendicular to the glass plates, and the tilt of the liquid-crystal molecules close to one plate is opposite to that at the other, characterized in that an electric field which is aligned approximately parallel to the plates and whose strength is below a value which is necessary for the Freedericksz transition is applied to the liquid-crystal layer having positive dielectric anisotropy and an initial deformation of the bend type.

In addition 1 sheet of drawings

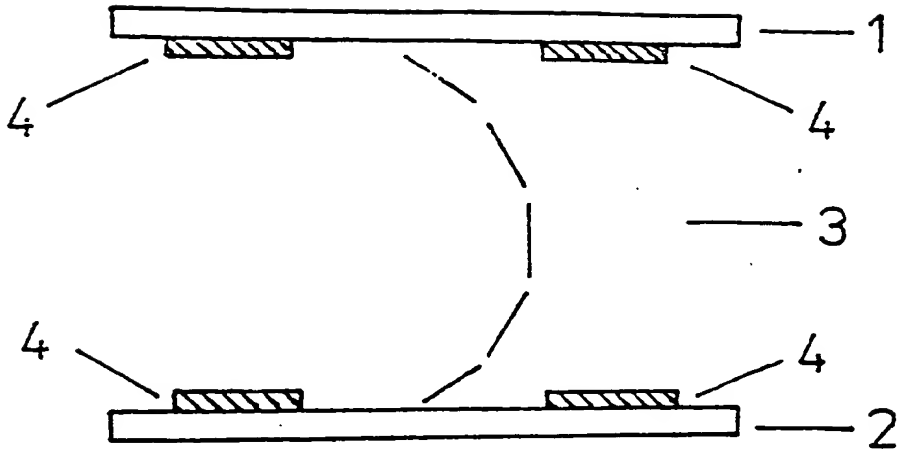

Fig. 1

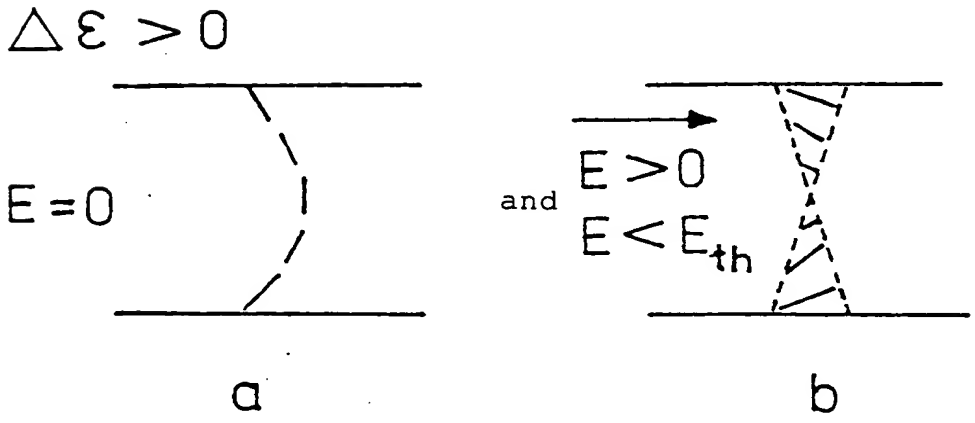

Fig. 2

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Process for producing a liquid-crystal component having a twisted structure

The invention relates to a process for producing liquid-crystal components for use in the area of electronics and in systems for information display. The object of the invention is to produce liquid-crystal components having a twisted structure which are distinguished by good reproducibility and homogeneity over the entire area. The object is achieved in accordance with the invention by subjecting a liquid-crystal layer which is arranged between two glass plates and has a positive dielectric anisotropy and an initial deformation of the splay type, to an electric field which is aligned approximately parallel to the plates and whose strength is above a value which is necessary for the Freedericksz transition.

Process for producing a liquid-crystal component having a twisted structure

Field of the invention

The invention relates to the production of liquid-crystal components having a twisted structure, as required in electronics and in systems for information display.

Characteristics of the technical solutions

It is known, as described by G. Porte in J. Physique 37 (1976) 1245, 38 (1977) 509 and 39 (1978) 213, to produce liquid-crystal components having a twisted structure. According to this, a liquid-crystal layer is located between two glass plates and is deformed under the influence of the plate surfaces in such a way that the plane of its deformation is approximately perpendicular to the glass plates and the tilt of the liquid-crystal molecules close to one plate is opposite to that at the other. In order to effect a twist into a 180° structure of the liquid-crystal layer, the tilt of each molecule located close to the glass plates must exceed a certain critical value measured against the perpendicular to the plate. This is achieved by the simultaneous effect of a layer of a surfactant applied in advance to the insides of the plates and the liquid-crystal flow, produced on filling, toward alignment of the liquid-crystal molecules.

It is disadvantageous that reproducibility cannot be ensured, and the resultant liquid-crystal components having a twisted structure have markedly different degrees of inhomogeneity over the entire area.

Aim of the invention

The aim of the invention are liquid-crystal components having a twisted structure and improved service properties.

Description of the essence of the invention

The object of the invention is to indicate a process for producing liquid-crystal components having a twisted structure which are distinguished by good reproducibility and homogeneity over the entire area.

This object is achieved by arranging, in a known manner, a liquid-crystal layer between two glass plates, which layer is deformed under the influence of the plate surfaces in such a way that the plane of its deformation is approximately [lacuna] to the glass plates, and the tilt of the liquid-crystal molecules close to one plate is opposite to that at the other.

In accordance with the invention, an electric field acting in the direction approximately parallel to the glass plates with a strength E above the value E_{th} necessary for a Freedericksz transition is applied to the liquid-crystal layer having negative dielectric anisotropy ($\Delta\varepsilon<0$) and an initial deformation of the splay type. In this way, it is possible to achieve highly reproducible liquid-crystal components having a twisted structure which are homogeneous over the entire area.

Illustrative embodiment

The invention is explained below with reference to an illustrative embodiment. As shown by Fig. 1 and 2a, a liquid-crystal layer 3 having negative dielectric anisotropy ($\Delta\varepsilon<0$) is arranged between two glass plates 1 and 2. Under the influence of the plate surfaces, this layer is deformed, its deformation plane being approximately perpendicular to the glass plates 1 and 2. The tilt of the liquid-crystal molecules close to one plate is opposite to that at the other, and their alignment in the centre of the layer is approximately parallel to the glass plates (deformation of the splay type). By means of the electrodes 4, which are arranged in a suitable manner on the insides of the plates, an electric field aligned parallel to the glass plates is applied to the liquid-crystal layer. If its field

strength E is greater than that of E_{th}, this deformation of the splay type is converted into the bend type (Fig. 2b), where the alignment of the molecules close to the glass plates is retained, but in the centre of the layer becomes virtually perpendicular to the plates. At a field strength of $E < E_{th}$ or if the field disappears ($E = 0$), the deformation of the bend type relaxes to give a twist into a 180° structure of the liquid-crystal layer (Fig. 2c).

Claim

Process for producing a liquid-crystal component having a twisted structure, in which a liquid-crystal layer is located between two glass plates and is deformed under the influence of the plate surfaces in such a way that the plane of deformation is approximately perpendicular to the glass plates, and the tilt of the liquid-crystal molecules close to one plate is opposite to that at the other, characterized in that an electric field which is aligned approximately parallel to the plates and whose strength is above a value which is necessary for the Freedericksz transition is applied to the liquid-crystal layer having negative dielectric anisotropy and an initial deformation of the splay type.

In addition 1 sheet of drawings

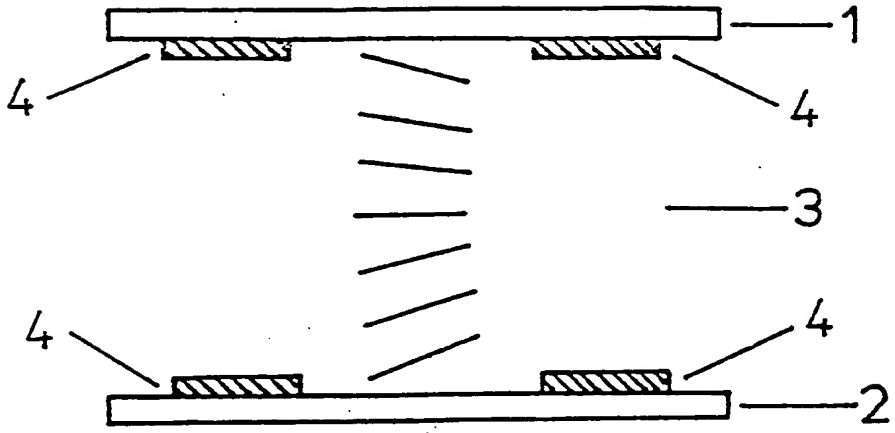

Fig.1

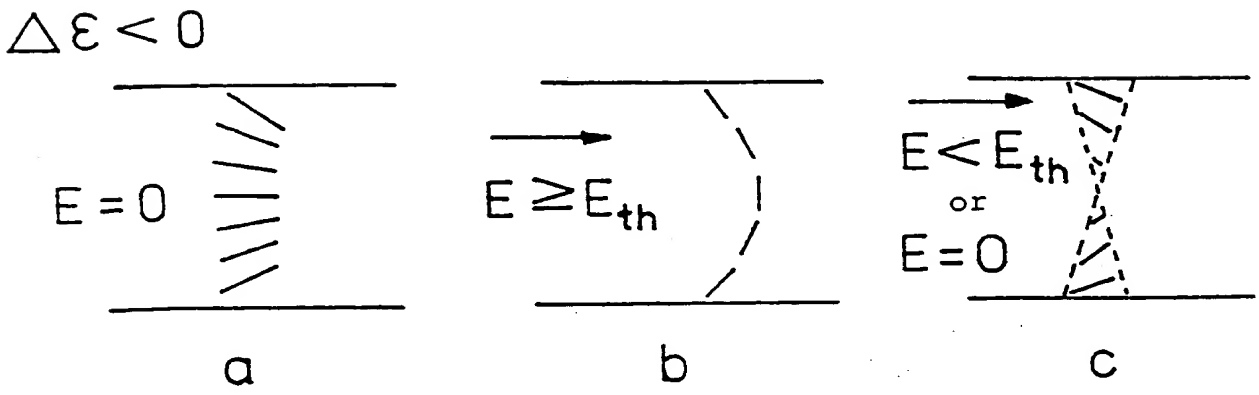

Fig. 2